

GUIDELINES ON THE USE OF LARVIVOROUS FISH FOR VECTOR CONTROL

INTRODUCTION

Fish have been widely used in public health, since as early as 1903. One of the most successful and widely used biological control agent against mosquito larvae is the top water minnow or mosquito fish *Gambusia affinis*. Fish other than *Gambusia* which has received the most attention as a mosquito control agent is *Poecilia reticulata*, the common guppy.

All the states have been advised to upscale the use of fish as biological control method in rural areas. The following guidelines have been prepared to guide the states in the use of fish for vector control.

ADVANTAGES OF USE OF FISH

- These fishes are self-perpetuating after its establishment and continuous to reduce mosquitoes larvi for long time.
- The cost of introducing larvivorous fish is relatively lower than that of chemical control.
- Use of fish is an environment friendly method of control.
- Larvivorous fish such as *Gambusia* and *Poecilia* prefer shallow water where mosquito larvae also breed.

CHARACTERISTICS OF LARVIVOROUS FISH

- Should be small in size to survive in shallow water.
- Should be surface feeders and carnivorous.
- Should be able to survive in the absence of mosquito larvae.
- Should be easy to rear.
- Should be able to withstand a wide range of temperature and light intensity.
- Should be hardy and able to withstand transport and handling.
- Should be insignificant/useless as food for other predators.
- Should have preference for mosquito larvae over other types of food available at the water surface.

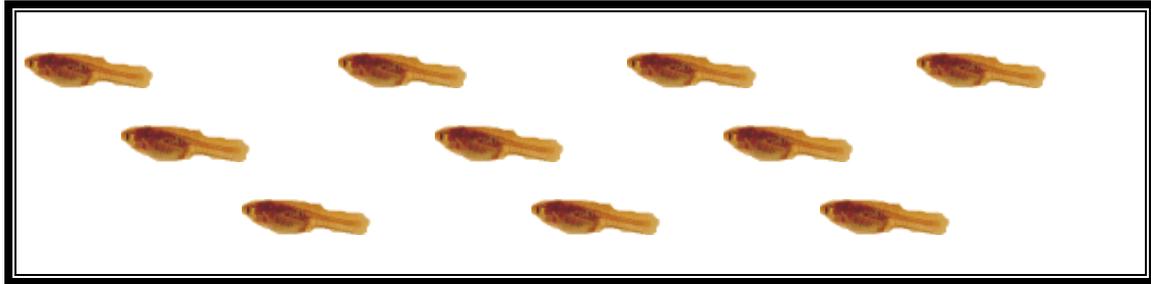
SPECIES OF FISH

1. Gambusia affinis

Gambusia affinis has been in use in India since 1928. It is an exotic species and has been distributed throughout the warmer and some temperate parts of the world.

Habitat

It is a very hardy fish and can adapt to wide variations in temperature as well as to chemical and organic content of the water but does not tolerate very high organic pollution. The optimum temperature for reproduction ranges from 24⁰C to 34⁰C but the fish can survive at freezing temperatures. The most suitable pH of water is between 6.5 and 9.9. *Gambusia* frequents areas especially suitable for the mosquito larvae. It lives and multiplies in ponds stocked with larger fish provided pond is shallow and has protective vegetation for refuge.



Size and Longevity

The maximum size attained by a male is 4.5 cm. and by a female 5.2 cm to 6.8 cm. Its life span is approximately 4±1 years.

Breeding Habit

The female matures in about 3 to 6 months. Each ovary contains approximately 120 eggs. Young ones are released in broods of 25–30 at a time. The young females have two gestations per season while the older females may have upto six generations per season. A season lasts about 30 days.

A single female may produce between 900 and 1200 off springs during its life span.

Breeding Season

Gambusia breeds throughout the year after maturity, especially in tropical conditions. In relatively colder climate such as is found in north and north-west India breeding period lasts from May to September and in warmer climate of southern India from April to November.

Larvivorous Efficiency

The larvivorous efficiency of *Gambusia* is due to following characters:

- A single full grown fish eats about 100 to 300 mosquito larvae per day.
- *Gambusia* is a surface feeder, hence it is suitable for feeding on both anophelines and culicines.
- It frequents the margins of the water container, pond or other ground water collections, except where there is dense vegetation at the margins of the water body.
- It is small and inedible.
- It can tolerate salinity.
- It can withstand transportation and does not require any specialized equipment or containers.

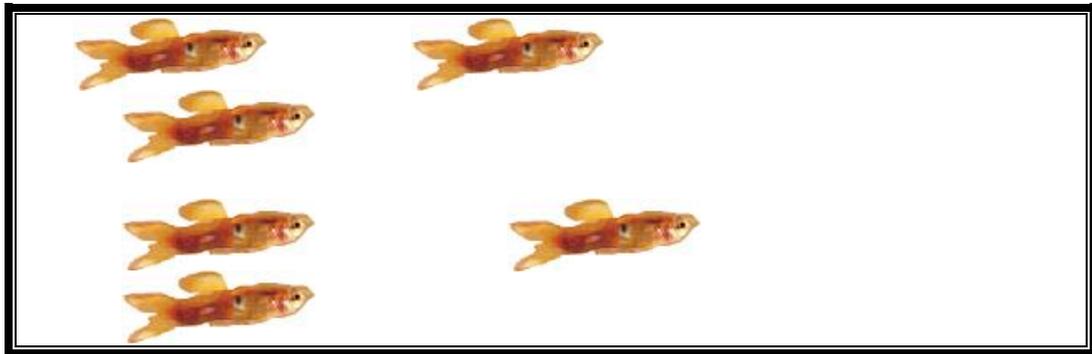
- It survives in new places (water bodies) and multiplies easily. After release when it becomes well established in a water body, the fish can survive in good numbers for years and does not require constant care.

2. *Poecilia reticulata* (GUPPY)

Like *Gambusia*, Guppy is also an exotic fish introduced in India in 1910. It is easy to care for, and it reproduces quickly and prolifically. It is now widely distributed in India and is an important larvivorous fish.

Habitat

It is a very hardy fish and survives in all types of water bodies. It tolerates high degree of pollution with organic matter. The temperature range suitable for breeding is from 24⁰C to 34⁰C. It can survive in water with pH ranging from 6.5 to 9.0 However, it can not survive in cold water (often below 10⁰C) and stock may need replenishment if the temperature fall below 10⁰C.



Size and Longevity

The male is 3 cm long, whereas the female is upto 6 cm in length. The Guppy lives for 4 ± 1 years.

Breeding Habitat

The guppy takes about 90 days to mature. Each ovary contains 100 to 160 eggs. The female gives birth to young ones in broods of 5 to 7 at a time. About 50 to 200 young ones are released by the female every four weeks.

Breeding Season

Reported to breed throughout the year at about four weeks interval after maturity. However breeding season will depend on climatic conditions. In warmer climate it may breed from April to November.

LARVIVOROUS EFFICIENCY

The larvivorous efficiency of *Poecilia* is due to following characters:

- A single fish eats about 80 to 100 mosquito larvae in 24 hours. Therefore it is comparatively less efficient than *Gambusia affinis*.
- It is a surface feeder.
- Negotiates margins of ponds more easily.
- It is highly carnivorous and parents or older brood may eat up their own young ones. Therefore, a fair amount of weeds is required in the water so that young ones can hide and survive.
- Tolerates handling and transportation very well.
- Does not require specialized equipment for transportation.
- Survives and reproduces when introduced into new water bodies. Once well established, it can be found in the habitat even after many years.

FISH HATCHERIES

The Hatchery for larvivorous fish can be established in:

- A Natural water body
- A special hatchery

The Natural water body

Criteria for selecting a water body for a fish hatchery are:

- It should be a permanent water body.
- Depth of water should be at least 1.5 metre or more.
- Water should be confined and without big natural outlet.
- The minimum size of water body should be at least 5 m X 4 m. The water body of 10 m X 5 m can support 50000 fish.
- It should be free from other carnivorous fish.
- Water should not be contaminated by chemical or other harmful substances.
- Easily accessible for daily or periodic inspection and for collection of fish.
- De-weeding in ponds and shallow water bodies and cleaning of margins should be carried out periodically.

Special Hatchery

Following points may be kept in view, while constructing the special hatcheries for the rapid reproduction of the fish:

- Fish hatcheries should be established at state, district headquarters, CHC/PHC and subcentre levels and other places so that adequate quantities of the fish are available for supply.
- There should be a constant supply of fresh water so that the required level of water in the tank does not drop.

- Submerged vegetation such as hydrilla, vallisneria should be available in the tanks.
- Salinity of water should not exceed 20 grams per litre. These fish may survive salinity up to 52 gms. per litre. But it cannot reproduce at this salinity level.
- Hatchery should not be subjected to strong water current and should be protected from heavy rains and floods.
- Entire tanks should be brick made, lined with good quality of cement plaster, thickness of wall about 0.5 m.
- The tank should be divided into two portions of equal size of 5 m X 4 m with central separator of 0.5 m thick.
- Area – sufficiently big for construction of 2 tanks of 5 m X 4 m (one for laying young ones and other for holding mature full grown fish).
- Depth of water in the hatchery should be 1.5 m.
- Proper outlet at the bottom of tank should be provided.
- Overflow outlet about 5 cm below inlet protected with proper wire mesh to prevent escape of fish.
- Floor of tank 0.5 m thick with slope from the partition towards sides.
- Proper inlet at 1.25 m height.
- Bottom of tank covered with uniform thickness of sand for about 10 cm.
- The bottom should be seeded with organic matter about 2 kg/m².
- The tank should be allowed to mature for 10–15 days.
- Minimum 25% of water should be replaced once a week.
- The fishes should be transferred from the tank to avoid over population.
- In case of scarcity of natural food, artificial food such as waste flour (atta) may be given. Chlorination of water beyond the tolerance levels, or presence of insecticides can be lethal to the fish.

TRANSPORTATION OF FISH

- The fish are best transported in small containers of up to 40 litres, such as plastic buckets and jerry cans, or in strong plastic bags, half filled with water from the rearing pond.
- Fish should be transported in water at ambient temperatures and should not be exposed to direct sunlight. The containers should have sufficient openings to allow flow of air.
- Take polythene bag of 3 -5 litre capacity.
- Fill it with 1.5 lit. of water.
- Introduce the fish in the bag till the total volume of water + fish is two litres.
- Bubble the oxygen in bag from O₂ cylinder or from air pump.
- Close the mouth of bag with a string leaving sufficient space at the top.
- Put the bag in a thermocol container and close the mouth of container.
- The container can be transported for a period of 24 hours without further filling oxygen. If the period of transport is more than 24 hours then arrange for change of water and oxygenate.

Collection of fishes

- Fishes are collected with help of netting, which is fitted on a circular iron ring of 60 to 90 cm diameter with a wooden handle.
- Sufficient quantity is collected by repeated dips.
- Collection in bucket or drum till they are packed for transportation.

Precaution during Transportation

- Fish do not tolerate sudden temperature changes.
- Preferably the fishes should not be given any food for 10–12 hours period prior to packing for transportation.

RELEASE OF FISH

- To release the fish in a water body, measure the perimeter of water body.
- Release the fishes at the rate of 5–10 fish per linear meter.
- If the larval density is high more fish up to 20 can be released.

Precautions during release of fish:

- Fishes should be released in the morning hours or in the evening.
- Before releasing ensure that the temperature of water both in container and in the larval habitat is more or less same.
- Clean out dense vegetation from the water body.
- Ensure that water body is free from predators of larvivorous fishes.

WHERE TO USE FISH

- Fish should be preferably introduced in all unused wells in the rural and peri-urban areas before the high mosquito breeding season to maximize impact. However, the fish may be used in such wells even if the seeding has been delayed.
- Fresh water bodies in rural areas such as stagnant ponds, slow moving streams quarry pits, large borrow pits, margins of ponds should be targetted apart from wells. Such places should be surveyed and numbered to facilitate subsequent monitoring of impact.
- In open mosquito breeding sites or rice fields, the fishes need to be protected from pesticides applied to crops, when used in rice fields.

MONITORING

- Supervisors should check the fish hatcheries at least once a month during the high transmission season.
- At least 10% of the sites where fish have been introduced should be checked for:
 - Whether fish have been introduced or not
 - Whether the fish are surviving or not
 - Identification of possible reasons, in case the introduced fish are not surviving.

REPORTING

- Monthly report to state programme officer and to NAMP containing following information:
 - Number of fish hatcheries established
 - Name of urban and rural areas using larvivorous fish
 - Number of unused wells marked for the introduction of the fish
 - Number of sites in the urban areas marked for the introduction of the fish.
 - Field reports of supervision of 10% of the sites
- Community participation and response.